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GREAT LAKES FORESTRY CENTRE
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Results of forest insect and disease surveys in the NORTHERN REGION of Ontario, 1987

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOUCES

L.S. MacLeod, V. Jansons and S. Payne
Miscellaneous Report No. 78

Canada

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92-05203/

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE NORTHERN REGION OF ONTARIO, 1987

(FOREST DISTRICTS: MOOSONEE, HEARST, KAPUSKASING, COCHRANE, CHAPLEAU, TIMMINS, KIRKLAND LAKE AND GOGAMA)

L.S. MacLEOD, V. JANSONS, and S. PAYNE

GREAT LAKES FORESTRY CENTRE

CANADIAN FORESTRY SERVICE

GOVERNMENT OF CANADA

1988

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SURVEY HIGHLIGHTS

Forest Insect and Disease Survey (FIDS) activities in the Northern Region of Ontario are summarized in this report. The 1987 field season was highlighted by major changes in insect populations, the most important being the disappearance of spruce and jack pine budworm infestations from the region. Forecasts indicate that spruce-fir and jack pine forests will be free of these pests in 1988.

The major defoliator of deciduous stands was the forest tent caterpillar (see Frontispiece) but egg-band counts indicate large reductions in the area and intensity of defoliation in 1988. The birch leafminer again caused severe foliar damage in white birch stands at many locations.

Pheromone trapping to detect the presence of gypsy moth was continued in provincial parks and captures were made in Hearst and Timmins districts. Other special projects included experimental trapping for spruce budworm and black army cutworm, and surveys to establish the distribution of the pinewood nematode.

The regular surveillance for forest diseases was supplemented by special surveys of white spruce plantations and by monitoring of plots for the effects of acid precipitation. Low temperatures in late May resulted in considerable foliar damage in the districts of Hearst, Kapuskasing and Cochrane.

Staff changes in the region in 1987 brought Steve Payne to the Chapleau-Gogama working area to replace Al Keizer, who was transferred to Kemptville. The assistance and cooperation of Ontario Ministry of Natural Resources (OMNR) and woods industry personnel in all districts is gratefully acknowledged.

The same format was followed in categorizing forest pests as in the 1986 Northern Region report.

Major Insects/Diseases

capable of causing serious injury to or death of living trees or shrubs

Minor Insects/Diseases

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs

Other Forest Insects/Diseases (Tables)

These tables provide information on two types of pest:

(1) those that are of minor importance and have not been known to cause serious damage to forest trees;

(2) those that are capable of causing serious damage but, because of low populations or for other reasons, did not cause serious damage in 1987.

L.S. MacLeod
V. Jansons
S. Payne

Frontispiece

Aerial photo of severe defoliation of trembling aspen (*Populus tremuloides* Michx.) by the forest tent caterpillar (*Malacosoma disstria* Hbn.)

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INSECTS

Major Insects

Large Aspen Tortrix, *Choristoneura conflictana* (Wlk.)

In 1986 an infestation of this leaf roller caused moderate-to-severe defoliation of trembling aspen (*Populus tremuloides* Michx.) over an area of 259,280 ha in the southern part of the Chapleau and Gogama districts. The infestation collapsed completely in 1987, no defoliation occurred and few larvae were found through the area infested in 1986. The tortrix was of little consequence in other districts of the region.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

There was a pronounced decline in both area and intensity of spruce budworm-caused damage in Ontario in 1987. A total of 7,189,763 ha of moderate-to-severe defoliation was mapped, a decline of 1,665,924 ha or 19% from last year's figure of 8,855,687 ha. All defoliation occurred in the North Central and Northwestern regions except for a small area (350 ha) in the Bracebridge District, Algonquin Region.

For the first time since 1968 no infestations or defoliation by the spruce budworm were found in any districts of the Northern Region. Remnants of the last two infestations in the Hearst and Gogama districts disappeared in 1987. Egg-mass surveys in late summer yielded only two egg clusters, both from Frost Township in Nagagamissis Provincial Park, Hearst District. Light traps operated at Remi Lake, Kapuskasing District, and at Chapleau, Chapleau District, captured only four adult moths each. Pheromone traps set out in Hearst and Kapuskasing districts in 1987 yielded very low numbers of adult moths in comparison with those set out in 1986 (Table 1).

On a provincewide basis, all defoliation occurred in the North Central and Northwestern regions except for a small area (350 ha) in Bracebridge District, Algonquin Region (Fig. 1).

Table 1. Summary of spruce budworm adult moth captures in pheromone traps at three locations in the region in 1986 and 1987.

Location (Twp)	Number of moths captured 1986	1987
Hearst District		
Frost	55	29
Larkin	63	6
Kapuskasing District		
Guilfoyle	41	0
Fauquier	8	1
Kirkland Lake District		
Pacaud	12	0
Gogama District		
Dublin	218	0
Chapleau District		
Neelands	14	0
Peters	99	0
Cochrane District		
St. John	7	0

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

Infestation forecasts on the basis of egg-mass surveys made in the autumn of 1986 were for a sharp reduction in jack pine budworm populations in the region, particularly in Chapleau and Gogama districts. This prognosis was substantiated when ground and aerial surveys in 1987 showed no defoliation, and few insects were recovered in ground sampling. Egg-mass surveys were conducted at 13 locations in the districts of Chapleau, Gogama, Timmins and Kirkland Lake, but not a single egg mass was recovered. This indicates an extremely low potential for an infestation in the region in 1988.

No extension of whole-tree or top mortality was recorded in 1987. Results of damage checks at five locations within the former infestation boundaries are summarized in Table 2.

NORTHWESTERN ONTARIO

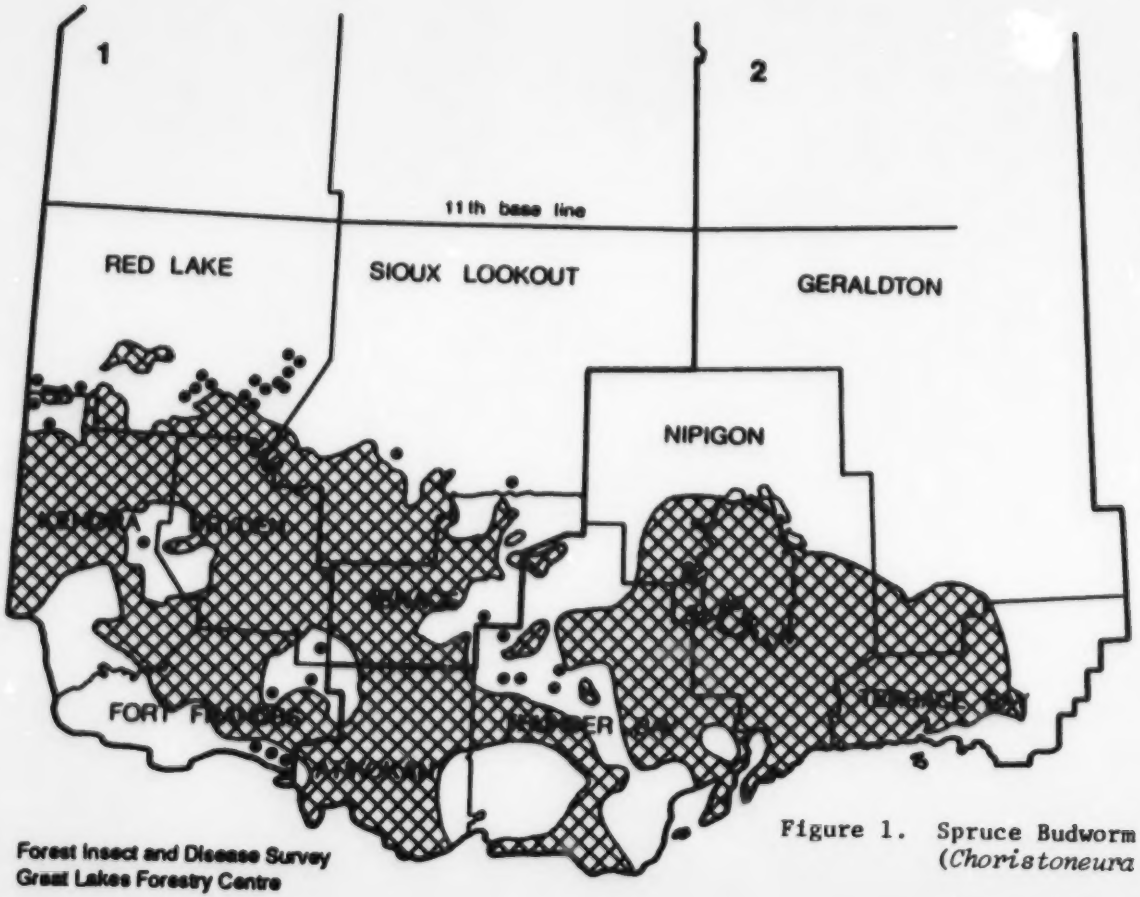

Figure 1. Spruce Budworm (*Choristoneura fumiferana* [Clem.])

Areas within which defoliation occurred in Northwestern Ontario in 1987

Moderate-to-severe defoliation ..... ▨ or ●

Table 2. Summary of top and whole-tree mortality in jack pine stands in two districts of the region in 1987.

Location (Twp)	Mortality (%) Whole tree	Dead top
Gogama District		
Westbrook	3	18
Mattagami	7	38
Noble	0	16
Chapleau District		
Kaplan	0	0
Wakami	0	0

Eastern Pine Shoot Borer, *Eucosma gloriola* Heinr.

Jack pine leaders infested with this insect were widely distributed through plantations in Timmins and Kirkland Lake districts but numbers were relatively low (Table 3). A similar situation was noted in the southwestern section of Chapleau District but the shoot borer was not found in other districts of the region.

Table 3. Summary of leader damage by the eastern pine shoot borer in three districts of the region in 1987 (counts based on the examination of 150 randomly selected jack pine trees at each location).

Location (Twp)	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Leaders killed (%)
Chapleau District				
Island Lake Tree Improvement Area	1.0	2,500	12	3.3
Chappise	2.9	1,500	44	2.0
Nimitz	1.5	1,500	134	1.3
Dalmas	2.2	500	20	4.0
Timmins District				
Robb	2.4	2,500	100	2.0
Macklem	1.0	4,000	50	3.0
Kirkland Lake District				
Tyrell	1.2	3,500	100	1.3
Gross	1.8	3,500	10	2.0

Birch Leafminer, *Fenusa pusilla* (Lep.)

High populations of this leafminer were reported in several districts of the region; in others, damage to white birch (*Betula papyrifera* Marsh.) was not extensive. In the town of Chapleau, white birch and weeping birch (*B. pendula* Roth) sustained up to 100% foliar discoloration and defoliation while lesser damage was recorded at Foleyet and Sultan in Daoust Township, Chapleau District, and at Gogama, Gogama District. In Timmins and Kirkland Lake districts, foliar damage was particularly conspicuous on ornamental trees in urban areas, on open-grown white birch in rural areas or in poorly stocked white birch stands. Groups of 10-100 trees were mined heavily in the Elk Lake, Earlton, Charlton, Englehart, Larder Lake and Kirkland Lake areas in Kirkland Lake District, with defoliation averaging 75%. Sporadic mining was general through Timmins District and on fringe trees along Hwy 631 in Frost and McEwing townships, Hearst District.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Major changes in forest tent caterpillar infestations occurred in the region in 1987. The total area of defoliation declined from 146,375 ha in 1986 to 112,912 in 1987, a decrease of 33,463 ha.

In the southwestern section of Kirkland Lake District, moderate-to-severe defoliation of aspen stands recurred over a large area (Fig. 2). The Gowganda infestation remained virtually unchanged in size, and defoliation through parts of Van Hise, Knight, Tyrell and Milner townships was generally severe. Two small pockets of defoliation were mapped in the Raven Lake area southeast of Larder Lake. These infestations totaled 112,452 ha of moderate-to-severe defoliation. No defoliation or caterpillars were found in the former Painkiller Lake infestation, which had persisted northeast of Matheson since 1982.

In Chapleau and Gogama districts, pronounced declines in population levels were observed. In the western part of Chapleau District small pockets of moderate-to-severe defoliation totaling 460 ha were mapped. Colonies of caterpillars were also found in Chapleau, Racine, Caouette and Peters townships, Chapleau District, and in MacMurchy Township, Gogama District, but defoliation was negligible in all instances.

Cocoon dissections at seven locations showed that adult emergence ranged from 22 to 60% and averaged 38.8% (Table 4). The pupal parasite *Sarcophaga aldrichi* Park. was the principal cause of mortality.

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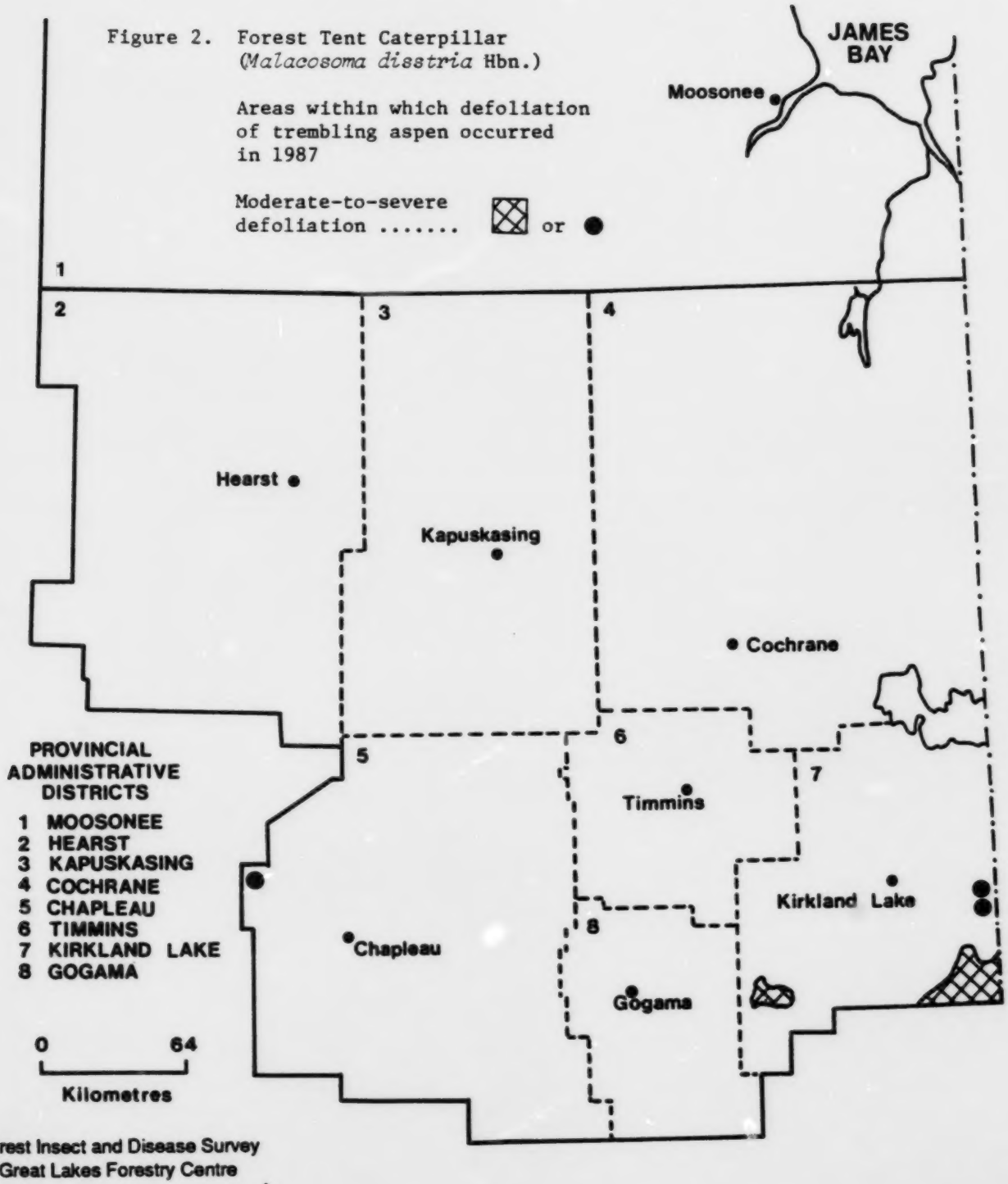


Figure 2. Forest Tent Caterpillar (*Malacosoma disstria* Hbn.)

Areas within which defoliation of trembling aspen occurred in 1987

Moderate-to-severe defoliation ..... or

Table 4. Summary of forest tent caterpillar cocoon dissections in three districts of the region in 1987 (counts based on the examination of 100 cocoons at each location).

Location (Twp)	Parasitized (%)	Diseased (%)	Adult emergence (%)
Chapleau District			
Chapleau	56	0	44
Gogama District			
MacMurchy	40	0	60
Kirkland Lake District			
Tyrell	56	2	42
Nicol	66	12	22
Henwood	74	0	26
Harley	68	0	32
Ingram	54	0	46

Egg-band counts made in the autumn indicate that further changes may be expected in 1988 (Table 5). Relatively low counts in the Gowganda infestation suggest that no extensive defoliation will occur in that area. A similar situation is probable through the central part of the Earlton-New Liskeard infestation, while pockets of moderate-to-severe defoliation may recur along the northern boundary, particularly in Ingram Township. Egg-band sampling at eight locations in Cochrane, Chapleau and Gogama districts all proved negative in 1987 (Fig. 3).

Light traps operated in Chapleau and at Remi Lake captured only 72 and 12 moths, respectively, in comparison with 667 and 26 at these locations in 1986.

Table 5. Summary of forest tent caterpillar egg-band counts on trembling aspen in Kirkland Lake District in 1987 and infestation forecasts for 1988.

Location (Twp)	Avg DBH of trees (cm)	No. of trees sampled	Total no. of egg bands	Infestation forecasts for 1988
Armstrong	13	3	11	light
Casey	13	3	10	light
Brethour	12	3	5	light
McFadden	15	3	2	light
Milner	22	3	9	light
Tyrell	22	3	16	light
Nicol	20	3	16	light
Cane	20	3	0	nil
Henwood	13	3	4	light
Ingram	10	1	24	heavy

Yellowheaded Spruce Sawfly, *Pikonema alaskensis* (Roh.)

A definite increase in sawfly-related damage was reported in white spruce *(Picea glauca* [Moench] Voss) and black spruce *(Picea mariana* [Mill.] B.S.P.) plantations, on snowhedges and on ornamental trees in most districts in the region (see photo page).

In Kapuskasing District defoliation ranged from 10 to 80% on 1- to 2-m-tall white spruce trees in Rene Brunelle Provincial Park in Fauquier Township and on 2-m-tall black spruce and white spruce in Howells and Mowbray townships. Similar damage was observed on 22 white spruce trees in a plantation in Fournier Township, Cochrane District. In Wakami Provincial Park, Chapleau District, defoliation averaged 33% on 2-m-tall white spruce trees and in Shoals Provincial Park 90% of 2-m-tall white spruce sustained 30% defoliation. In Missinaibi Provincial Park 25% defoliation was found on 40% of the trees in the boat launching area. Up to 60% loss of foliage was common on ornamental trees in the town of Chapleau. Moderate-to-severe defoliation of black spruce and white spruce was common in urban, rural and forest situations in Kirkland Lake and Timmins districts. The heaviest damage was recorded in the Ramore-Matheson-Shillington-Monteith areas where defoliation ranged from 10 to 75% on snowhedges and open-grown trees. Approximately 500 trees averaging 2-m in height sustained 70% defoliation along Hwy 65 in the Elk Lake area, Kirkland Lake District. Single, severely defoliated trees were observed at many other locations in all districts.

NORTHERN REGION

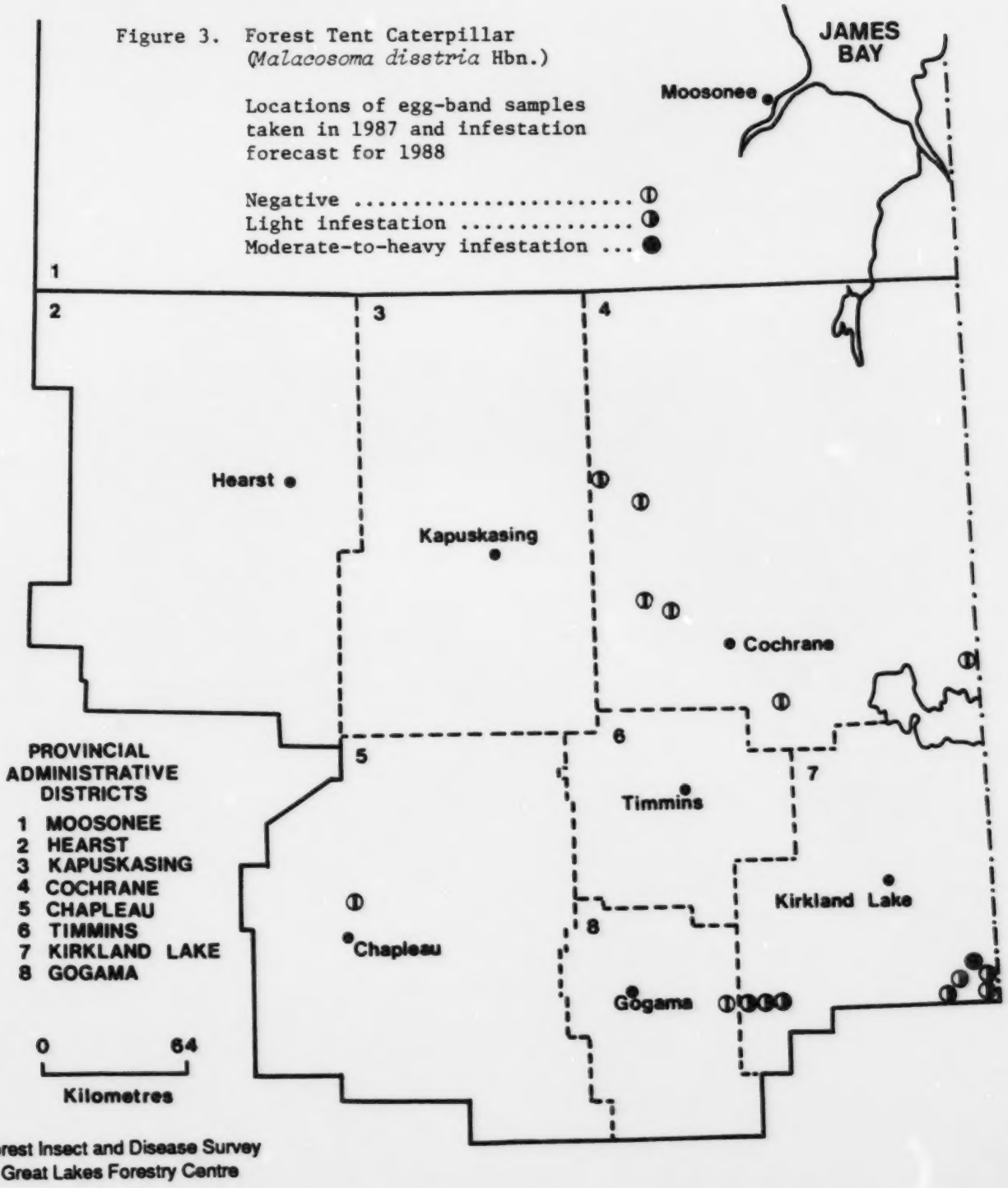


Figure 3. Forest Tent Caterpillar (*Malacosoma disstria* Hbn.)

Locations of egg-band samples taken in 1987 and infestation forecast for 1988

White Pine Weevil, *Pissodes strobi* (Peck)

In recent years, leader mortality caused by this weevil has not been extensive in Hearst, Kapuskasing and Cochrane districts but has been much more prevalent in the southern districts of the region. This situation continued in 1987 and was reflected in quantitative sampling through pine (*Pinus* spp.) and spruce (*Picea* spp.) plantations (Table 6).

Table 6. Summary of damage caused by the white pine weevil in seven districts of the region in 1987 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Tree species	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Leaders killed in 1987 (%)
Cochrane District					
Freele	jP	1.2	2,500	3	1.3
Clute	wS	1.6	1,600	5	0.7
Hearst District					
Arnott	wS	1.4	2,500	5	1.3
Larkin	jP	1.2	1,600	5	0.7
Kapuskasing District					
Fauquier	bS	2.3	600	1	2.0
Pearce	bS	1.5	1,200	10	0.7
Gogama District					
Invergarry (Camp 303)	jP	1.7	2,500	100	28.7
Invergarry (E of Hwy 144)	jP	2.0	1,000	15	12.3
Sheard	jP	2.0	1,500	60	22.3
Chapleau District					
Chappise	jP	2.9	1,500	44	15.3
Nimitz	jP	1.5	1,500	134	12.3
Hill	jP	3.0	1,500	20	4.0
Warren	jP	1.5	1,500	121	0.0
D'Arcy	jP	2.0	2,000	10	6.0
Dalmas	jP	2.2	500	80	19.3

(cont'd)

Table 6. Summary of damage caused by the white pine weevil in seven districts of the region in 1987 (counts based on the examination of 150 randomly selected trees at each location) (concl.).

Location (Twp)	Tree species	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Leaders killed in 1987 (%)
Chapleau District (cont'd)					
Island Lake Tree Improvement Area	jP	1.2	2,500	15	10.6
Copperfield	jP	2.0	1,500	68	0.6
Marshall	jP	2.5	1,500	5	10.7
Busby	wS	1.5	1,500	2	1.2
Alcorn	bS	1.8	1,500	30	2.0
Langlois	jP	1.7	2,500	15	20.0
Hutcheon	jP	1.7	1,600	10	14.7
Kirkland Lake District					
Tyrell	jP	1.2	3,500	100	26.0
Chamberlain	jP	1.4	5,000	5	6.0
McEvay	wS	4.5	4,000	5	2.0
Gross	jP	1.8	3,500	10	20.6
Michie	jP	2.2	3,500	100	37.3
Timmins District					
Macklem	jP	1.0	4,000	50	12.6
Robb	jP	2.4	2,500	50	4.0

Larch Sawfly, *Pristiphora erichsonii* (Htg.)

Although tamarack *(Larix laricina* [Du Roi] K. Koch) stands were surveyed at numerous locations through the region in 1987 not a single colony of this sawfly was recovered and no defoliation was observed.

Mountain-ash Sawfly, *Pristiphora geniculata* (Htg.)

After three consecutive years of very low population levels, a slight resurgence in numbers of this sawfly was recorded in 1987. In Chapleau District damage ranging from trace to 65% defoliation was common through the southern part of the district and ornamental trees in Chapleau were approximately 50% defoliated. In other districts of the region, the sawfly was rarely found and little damage to either urban or forest trees resulted.

Early Aspen Leafroller, *Pseudexentera oregonana* Wlshm.

Large numbers of this insect occurred at several locations in the northern part of Hearst District. Moderate-to-severe defoliation of mature aspen stands over a total area of 7,460 ha was mapped along the Kenogami, Nagagami and Kabinakagami rivers south of the abandoned village of Mammamattawa. Lighter defoliation, generally within the moderate range, was observed over an area of 1,960 ha in the Wren and Bluejay lakes area north of Rogers Township. In Chapleau District small numbers of larvae were found at a few locations in Deans and Peters townships, but the insect caused no damage in other districts of the region.

Minor Insects

Paleheaded Aspen Leafroller, *Anacampsis niveopulvella* (Chamb.)

Several small areas of moderate-to-severe damage caused by this early-season defoliator of trembling aspen were surveyed in the northwestern part of Chapleau District. Defoliation was confined to mature stands on hilltop sites and totaled approximately 25 ha at 10 locations. The largest area of damage was in Marshall Township, where two stands comprising about 5 ha sustained 70% defoliation.

Jack Pine Tip Beetle, *Conophthorus banksianae* McP.

Twig mortality caused by this beetle was conspicuous in jack pine (*Pinus banksiana* Lamb.) plantations through the region (see photo page). In most instances damage was confined to lateral branches and consequently did not affect tree growth seriously. An exception was recorded in a 10-ha plantation in Langlois Township, Chapleau District, where 8.5% of 2-m-high trees suffered leader mortality and 15.6% had lateral mortality as well. At one location in Missinaibi Provincial Park five semimature jack pine trees sustained 50% mortality of the 1987 lateral growth.

Table 7. Other forest insects.

Insect	Host(s)	Remarks
Aceria sp. nr. *dispar* (Nalepa) Aspen leaf mite	tA	common throughout Kirkland Lake and Timmins districts, particularly conspicuous in stands defoliated by forest tent caterpillar
Acrobasis betulella Hlst. Birch tubemaker	wB	less than 5% defoliation at scattered locations through Chapleau, Kirkland Lake and Timmins districts
Adelges lariciatus (Patch) Spruce gall adelgid	wS	5-15% of the shoots damaged in a plantation in Bryce Twp, Kirkland Lake District; extremely low populations through rest of region
Agromyza aristata Mall. Elm agromyzid leafminer	wE	less than 10% defoliation on shade trees in the town of Smooth Rock Falls, Cochrane District

(cont'd)

Table 7. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Aphrophora cribrata (Wlk.) Pine spittlebug	jP	low numbers in most jack pine plantations and natural stands throughout the region
Archips cerasivorana (Fitch) Uglynest caterpillar	Ch	Up to 10% of examined trees in rural areas in the vicinity of Hilliardton, Earlton and New Liskeard in Kirkland Lake District were damaged.
Cecidomyia resinicola (O.S.) Jack pine resin midge	jP	up to 25% of shoots killed in several plantations in Chapleau, Kirkland Lake and Timmins districts
Choristoneura rosaceana (Harr.) Obliquebanded leafroller	decid-uous	1-10% defoliation on a wide variety of hosts in Chapleau, Kirkland Lake and Timmins districts
Coleophora laricella (Hbn.) Larch casebearer	tL	1% foliar damage by trace populations in a 5-ha stand, Fawn Township, Chapleau District
Contarinia negundifolia Felt Boxelder leafgall midge	mM	100% of the examined shade trees infested in the town of Cochrane, Cochrane District
Cryptorhynchus lapathi (L.) Poplar-and-willow borer	Ch	one bush killed by this wood borer in Cassidy Twp, Chapleau District
Dendroctonus simplex LeC. Eastern larch beetle	tL	large populations found in a few dead and dying trees, Blount Township, Cochrane District
Dioryctria reniculelloides Mut. & Mun. Spruce coneworm	wS, bS	less than 5% defoliation in the southern part of Timmins District
Dioryctria zimmermani (Grt.) Zimmerman pine moth	jP	one semimature tree with leader killed in a 15-ha plantation in Dalmas Twp, Chapleau District

(cont'd)

Table 7. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Enargia decolor (Wlk.) Aspen twoleaf tier	tA	small numbers at many locations in Chapleau, Gogama, Kirkland Lake and Timmins districts
Epinotia solandriana L. Birch-aspen leaf roller	tA, wB	5-10% defoliation at many scattered points in Chapleau, Gogama, Kirkland Lake and Timmins districts
Eupareophora parca (Cress.) Spiny ash sawfly	bAs	The upper crowns of 50% of the ash (*Fraxinus* spp.) stands examined were lightly to moderately defoliated in Chapleau, Gogama and Kirkland Lake districts.
Fenusa dohrnii (Tischb.) European alder leafminer	Al	less than 2% leafmining at many points in Kirkland Lake District and in McKeown Twp in Timmins District
Framinghamia helvalis (Wlk.) Poplar leafroller	hybrid Po	less than 1% of leaves infested at the Bonner Tree Improvement Centre, Fauquier Twp, Kapuskasing District
Gilpinia hercyniae (Htg.) European spruce sawfly	wS	small numbers collected from most districts in the region
Gonioctena americana (Schaef.) American aspen beetle	tA	roadside regeneration up to 60% defoliated in Panet Twp, Chapleau District; small numbers on fringe trees in McGarry, McFadden and McVittie twps, Kirkland Lake District
Gonioctena notmani (Schaef.) Willow leaf beetle	w	90-100% defoliation of roadside bushes in Panet Twp, Chapleau District
Hemichroa crocea (Geoff.) Striped alder sawfly	Al	a few colonies in Clifford Twp, Kirkland Lake District
Hyphantria cunea (Dru.) Fall webworm	decid-uous	5% defoliation of alder (*Alnus* spp.) and willow (*Salix* spp.) near Tomstown, Englehart and Belle Vallee in the Kirkland Lake District

(cont'd)

Table 7. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Macrohaltica ambiens (LeC.) Alder flea beetle	Al	90% defoliation of roadside bushes in Caouette Twp, Chapleau District; also 75-100% defoliation of shrubs at many points in Kirkland Lake and Timmins districts
Malacosoma californicum pluviale (Dyar) Northern tent caterpillar	decid-uous	occasional colonies along bush roads and in cut-over areas in Chapleau, Kirkland Lake and Timmins districts
Meroptera pravella Grt. Lesser aspen webworm	tA	less than 10% defoliation through aspen stands in Kirkland Lake and Timmins districts
Micurapteryx salicifoliella Cham. Willow leafminer	w	90-100% defoliation observed through the northern part of the region
Nematus hudsoniimagnus Dyar Poplar sawfly	bPo	25% defoliation of small fringe trees in Arnott and Stoddart twps, Hearst District
Nematus limbatus Cress. Willow sawfly	w	5-10% defoliation observed in Stanley Twp, Kapuskasing District
Neodiprion abietis complex Balsam fir sawfly	wS	less than 1% defoliation observed in Calder Twp, Cochrane District
Neodiprion nanulus nanulus Schedl. Red pine sawfly	jP	less than 5% defoliation in Hassard and Thornloe twps, Timmins District, and in Garibaldi Twp, Gogama District
Neodiprion virginianus complex Redheaded jack pine sawfly	jP	10-15% defoliation found at scattered sampling points through the region
Neurotoma inconspicua (Nort.) Plum webspinning sawfly	ch	seven nests found in a 0.5-ha area in Gallagher Twp, Chapleau District

(cont'd)

Table 7. Other forest insects (cont'd).

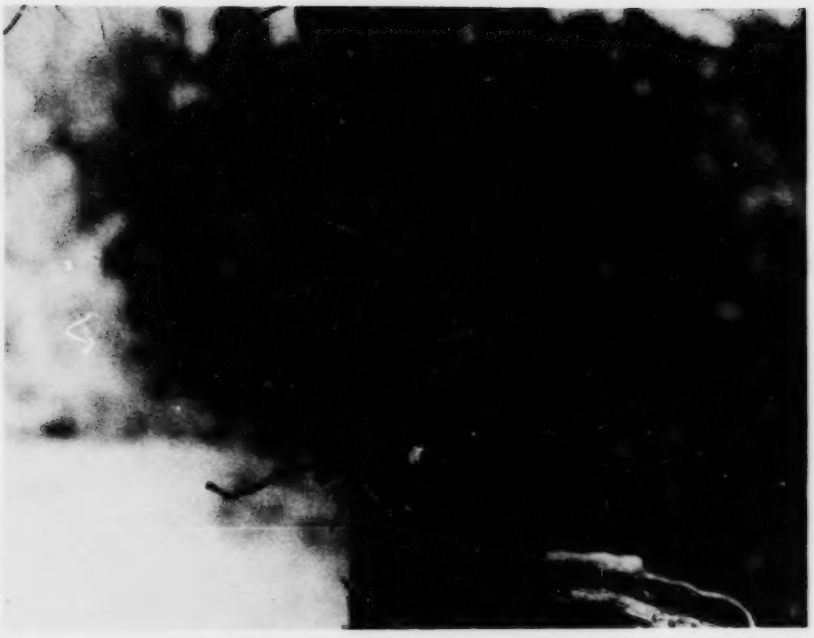
Insect	Host(s)	Remarks
Paradiplosis tumifex Gagné Balsam gall midge	bPo	common through the central and southern parts of Kirkland Lake District
Petrova albicapitana (Busck) Northern pitch twig moth	jP	less than 10% damage found in most plantations in Timmins and Kirkland Lake districts
Phyllonorycter nipigon (Free.) Balsam poplar leafblotch miner	bPo	up to 90% defoliation at one point in McVittie Twp, Kirkland Lake District
Phyllonorycter ontario (Free.) Aspen leafblotch miner	tA	Small pockets of aspen regeneration up to 100% mined were common through Timmins and Kirkland Lake districts; elsewhere in the region, scattered areas of low populations were observed.
Pikonema dimmockii (Cress.) Greenheaded spruce sawfly	wS	less than 5% defoliation at several sampling points in the region
Pineus similis (Gill.) Ragged sprucegall adelgid	wS	less than 1% shoot damage through the northern portion of the region
Pleroneura brunneicornis Roh. Balsam shootboring sawfly	bF	common through the central part of Kirkland Lake District
Prociphilus tessellatus (Fitch) Woolly alder aphid	Al	Roadside bushes had 100% of their branches heavily infested with these aphids in Strathearn Twp, Chapleau District.
Profenusa thomsoni (Konow) Ambermarked birch leafminer	wB	1-5% of foliage mined on semi-mature trees in Cassidy Twp, Chapleau District
Pyrrhalta d. decora (Say) Gray willow leaf beetle	W	90-100% defoliation of shrubs common in the Shillington-Monteith-Barbers Bay areas in Timmins and Kirkland Lake districts; pockets of heavy damage found through the entire region

(cont'd)

Table 7. Other forest insects (concl.).

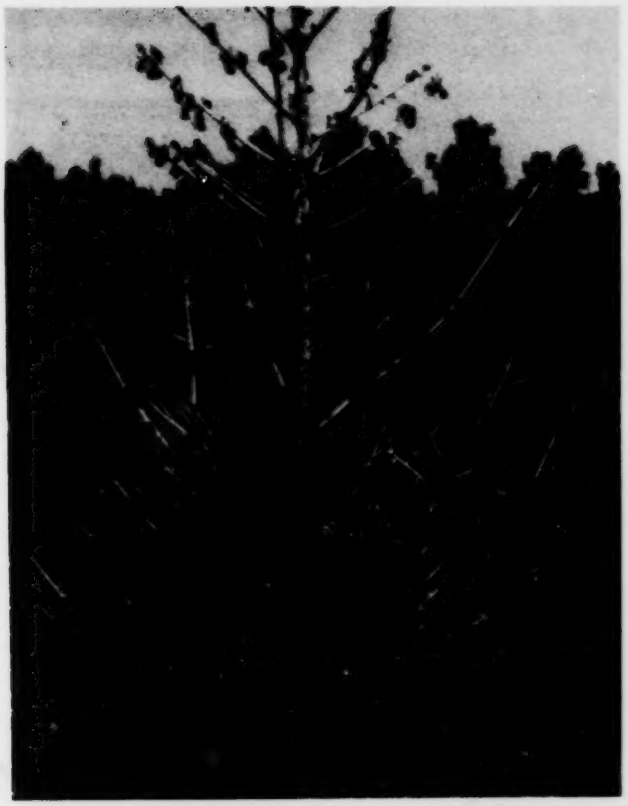
Insect	Host(s)	Remarks
Pyrrhalta tuberculata (Say) Willow leaf beetle	W	90% defoliation of shrubs in the Reeves Twp seed production area, Chapleau District
Pyrrhia exprimens (Wlk.) Variable caterpillar	bPo	less than 5% damage on small trees in Arnott Twp, Hearst District, O'Brien Twp, Kapuskasing District, and Racine Twp, Chapleau District
Toumeyella parvicornis (Ckll.) Pine tortoise scale	jP	single and small groups of trees heavily infested at several locations in Timmins and Kirkland Lake districts
Vasates quadripes Shimer Maple bladdergall mite	siM	up to 90% foliar damage on shade trees in the town of Cochrane, Cochrane District

Feeding by the yellowheaded spruce sawfly (*Pikonema alaskensis* [Roh.]) larva (left) can cause severe defoliation of white spruce (*Picea glauca* [Moench] Voss) (below).



Large gall caused by western gall rust (*Endocronartium harknessii* [J.P. Moore] Y. Hirats.), a common disease in parts of the Northern Region

Semimature jack pine (*Pinus banksiana* Lamb.) with 65% of its shoots killed by jack pine tip beetle (*Conophthorus banksianae* McP.) in Missinaibi Provincial Park, Chapleau District



Young white spruce (*Picea glauca* [Moench] Voss) severely defoliated by yellow-headed spruce sawfly (*Pikonema alaskensis* [Roh.]), with new shoots killed by frost

ARNEWS plot located in Kirkland Lake District

Major Diseases

Armillaria Root Rot, *Armillaria mellea* (Vahl:Fr.) Kummer

There was no change in the incidence of this fungus in 1987. Trees with visible symptoms of root rot were found in the majority of plantations throughout the region but no extensive mortality occurred. Damage in the sample plots listed in Table 8 is representative of that found in the region.

Table 8. Summary of jack pine mortality caused by Armillaria root rot in five districts in the region in 1987 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Tree species	Avg ht of trees (m)	Estimated no. of trees (ha)	Estimated area affected	Current mortality (%)
Chapleau District					
Chappise	jP	2.9	1,500	44	1.3
Dalmas	jP	2.2	500	20	1.3
Warren	jP	1.5	1,500	121	1.3
Cochrane District					
Howells	jP	1.8	2,500	50	0.7
Hearst District					
Arnott	wS	0.8	200	5	0.7
Kirkland Lake District					
Chamberlain	jP	1.2	4,000	2	0.7
Timmins District					
Macklen	jP	1.0	4,000	3	1.3

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

Surveys were conducted in pine plantations and natural stands through the region to locate the presence of Scleroderris canker. At the same time, disease samples were submitted to the Great Lakes Forestry Centre in Sault Ste. Marie for cultural confirmation and race identification (i.e., to determine if the pathogen is the North American or the European form of the disease). Samples were submitted from the following areas, which had <1% damage: Kettle Lake Provincial Park, Timmins District; Bowman, Munro and McCann townships, Kirkland Lake District; Nimitz and Ivanhoe townships, Chapleau District. All samples submitted were identified as the North American race of the fungus.

Spruce Needle Rusts, *Chrysomyxa ledi* (Alb. & Schwein.) de Bary var. *ledi* and *C. ledicola* (Peck) Lagerh.

Occurrence of this midsummer disease of both black spruce and white spruce was generally low throughout the region. A light incidence of infected needles was found in most spruce plantations and natural stands surveyed. One exception was in a 2-ha natural black spruce stand in Penhorwood Township, Chapleau District, where 100% of the 2-m-tall trees on a wet site were infected and had 30% foliar damage. In most cases defoliation caused by spruce rust is of little consequence and no control measures are needed.

Pine Needle Rust, *Coleosporium asterum* (Dietel) Sydow

Low levels of this jack pine foliage rust were found in scattered areas through the region. In most instances, foliar damage was limited to low levels, but moderate damage did occur in several areas (Table 9). This disease causes premature needle cast of the previous year's foliage. As a result, light-to-moderate damage seldom has a serious effect on the trees and rarely warrants any control measures.

Tar Spot Needle Cast, *Davisomycella ampla* (J. Davis) Darker

This early-season foliage disease, which causes discoloration and premature casting of one-year-old foliage of jack pine, was observed at low levels through the entire region. However, light-to-moderate damage was surveyed in a few scattered plantations (Table 10). In addition, small pockets of mature trees with moderate damage were encountered at widely scattered points in the region.

Table 9. Summary of damage caused by needle rust of jack pine in four districts in the region in 1987 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	Foliar damage (%)
Chapleau District					
Alcona	0.5	2,500	5	50.0	7.0
D'Arcy	1.0	2,500	20	100.0	33.0
Keith	0.5	2,000	10	100.0	15.0
Marshall	1.5	2,500	10	100.0	7.0
Nimitz	1.5	2,000	130	100.0	10.0
Warren	0.3	2,500	10	18.6	3.4
Cochrane District					
Avon	1.4	2,500	10	22.7	7.5
Gogama District					
Invergarry	1.0	2,500	20	90.0	5.0
Hearst District					
Twp 238	1.2	2,500	100	72.0	5.5

Table 10. Summary of damage caused by tar spot needle cast in three districts in the region in 1987 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	Defoliation level (%)
Chapleau District					
Chappise	1.7	2,500	44	2.0	3.5
Hill	2.0	2,000	15	5.0	10.0
Hutcheon	0.8	2,500	10	10.3	2.4
Nimitz	1.0	2,000	5	25.0	5.0
Cochrane District					
Freele	0.8	2,500	3	44.7	11.5
Gogama District					
Garibaldi	2.0	2,500	50	10.0	10.0
Invergarry	2.0	2,000	20	20.0	10.0

Western Gall Rust, *Endocronartium harknessii* (J.P. Moore) Y. Hirats.

This rust was found at various levels in many jack pine stands throughout the region. In most instances branch galls were more common but occasionally small trees in plantations were girdled and killed by stem galls (see photo page). Severe damage was most prevalent at several locations in Kirkland Lake District (Table 11) and Chapleau District (Table 12). Although final identification of the organism has not been confirmed in Kirkland Lake District, *Endocronartium harknessii* is suspected as the causal agent. Because this rust is spread from tree to tree and needs no alternate host, it can be introduced into recent plantings from nearby infected trees. Also, it appears that some trees are infected when planted, and this suggests that the infection may occur in the nursery.

Table 11. Summary of damage caused by stem galls on two year old jack pine outplantings at five locations in Kirkland Lake District.

Location (Twp)	No. of plots examined	Area affected (ha)	Trees with stem galls (%)
Ben Nevis	15	29	14
Ossian	7	13	29
Beauchamp	14	28	26
Catherine	14	28	20
Hearst	14	27	28

Table 12. Summary of damage by western gall rust in Chapleau District in 1987 (counts based on the examination of 150 trees at each location).

Location (Twp)	Avg ht of trees (m)	Estimated no. of trees per (ha)	Estimated area affected (ha)	Trees affected (%)	Trees affected severely (%)
Caverly	0.5	4,444	5	15.0	15.0
Chappise	1.6	2,500	44	6.0	2.6
Copperfield	0.5	2,500	2	15.0	15.0
Hutcheon	0.8	2,500	10	10.9	4.6
Island Lake Tree Improvement Area	0.6	4,444	12	18.0	18.0
Neelands	0.7	4,444	5	48.0	35.0

Fire Blight, *Erwinia amylovora* (Burr.) Winslow *et al.*

There was a high incidence of branch and stem mortality of mountain-ash (*Sorbus americana* Marsh.) in the town of Iroquois Falls, Cochrane District, where numerous ornamental trees were infected. Several diseased trees were observed in the town of Kapuskasing, Kapuskasing District. In forested situations, small numbers of scattered, infected mountain-ash were observed in Alcorn and Copperfield townships, Chapleau District.

This bacterial disease produces branch and stem cankers, twig blight and dieback. Leaves and blossoms of mountain ash infected with fire blight suddenly wilt and turn black, and the twigs die. The disease may spread from twigs to branches and produce extensive cankers, and stem mortality follows. Control of fire blight consists of pruning infected branches about 10 cm below the cankers and burning the infected material to help prevent the spread of the disease.

Septoria Leaf Spot, *Mycosphaerella populicola* G.E. Thompson

Infection levels of this foliar disease were high in most balsam poplar (*Populus balsamifera* L.) stands examined. In the northern part of the region, the disease was found with balsam poplar leaf blight (*Linospora tetraspora* G.E. Thompson). Discoloration of foliage began in early July and premature leaf drop occurred in August. By the beginning of September, many stands were 100% defoliated. This disease was present in previous years but little foliar damage resulted until 1987.

On native poplars, this fungus causes only the foliar damage mentioned above. However, on hybrid poplars, the imperfect stage (*Septoria musiva* Peck) causes the septoria canker. Leaders and side shoots are soon girdled and the infection spreads from the lateral branches into the main stem, where cankers develop that ultimately girdle and kill the host.

Table 13. Other forest diseases.

Organism	Host(s)	Remarks
Blumeriella jaapii (Rehm) v.Arx Shot-hole	Ch	100% of understory trees with 30% foliar damage in a 10-ha SPA in Nimitz Twp, Chapleau District
Ceratocystis ulmi (Buism.) C. Moreau Dutch elm disease	wE	no further extension of the range of this organism in Kirkland Lake District
Ciborinia whetzelii (Seaver) Seaver Ink spot of aspen	tA	trace level of damage on a few scattered trees, in Idington Twp, Kapuskasing District
Cryptodiaporthe populea (Sacc.) Butin Poplar canker	lPo	caused severe branch and top mortality of small trees at one location in the town of Kapuskasing, Kapuskasing District
Fomitopsis pinicola (Swartz : Fr.) Karsten Brown crumbly rot	wS	fruiting bodies found on several windthrown trees in Timmins District
Gloeophyllum saepiaria (Wulfen : Fr.) Karsten Brown cubical rot	wS	organism collected in the root of a dead tree, in Opasatika Twp, Kapuskasing District
Inonotus tomentosus (Fr.) Gilbertson Tomentosus root rot	ground	fruiting bodies found in an experimental compartment of white spruce at Bonner Tree Improvement Centre, Kapuskasing District
Isthmiella crepidiformis (Darker) Darker Needle cast	bS	30% of needles infected on several ornamental trees in Lowther Twp, Kapuskasing District
Isthmiella faullii (Darker) Darker Needle cast	bF	100% of natural regeneration in a 1-ha area with 10% foliar damage at the junction of Hwy 101 and Hwy 129 in Chapleau Twp, Chapleau District
Leucostoma persoonii (Nitschke) Höhnel Cytospora canker	aMo	organism found in association with fire blight in Iroquois Falls, Cochrane District

(cont'd)

Table 13. Other forest diseases (concl.)

Organism	Host(s)	Remarks
Lophodermium sp. Needle cast	rP	trace level of damage on lakeside ornamentals, Lloyd Twp, Chapleau District
Melampsora medusae Thüm. Larch-poplar rust	bPo	heavy damage on several trees in Teck Twp, Kirkland Lake District
Melampsora paradoxa Dietel & Holway Larch-willow rust	tL, W	rust found at trace levels on larch (*Larix* spp.) and the alternate host, willow (*Salix* spp.), in a 5-ha stand in Calais Twp, Chapleau District
Phaeolus schweinitzii (Fr.) Pat. Brown cubical rot	bF	fruiting bodies found on roots of decadent trees in Barber Twp, Kirkland Lake District
Pucciniastrum epilobii Otth Fireweed rust	bF	100% of natural regeneration with 25% foliar damage in a 5-ha stand in Brutus Twp, Chapleau District
Rhytisma salicinum (Pers.) Fr. Tar spot	W	heavy infection of willow bushes in McVittie Twp, Kirkland Lake District
Venturia macularis (Fr.) E. Müller & v. Arx Shoot blight	tA	widely distributed in aspen regeneration through the region but damage generally insignificant

ABIOTIC DAMAGE

Frost Injury

On 22 May freezing temperatures, in combination with freezing rain and snowfall, caused severe damage to balsam fir *(Abies balsamea* (L.) Mill.), tamarack and white spruce through central Hearst and Kapuskasing districts and resulted in pockets of lighter damage in Cochrane, Chapleau and Gogama districts (Fig. 4). Most severely affected were open-grown, fringe and large overstory balsam fir, with 75-100% flushing bud mortality common on numerous trees examined in Rogers, Frost, Wicksteed, Arnott and Studholme townships, Hearst District, and in Bourinot, Guilfoyle and Swanson townships, Kapuskasing District. Pockets of light-to-moderate damage were observed on balsam fir in Gilliland Township, Chapleau District, in Garibaldi Township, Gogama District, and in St. John, Raven and Dempsey townships, Cochrane District (Table 14). Since the freezing temperatures coincided with flowering of white spruce, the 1987 cone crop was severely reduced in Hearst, Kapuskasing, Cochrane, Chapleau and Gogama districts. Generally, the damage to new growth of white spruce was insignificant because the buds were still dormant during the period of frost. Foliar damage amounted to 20-30% on tamarack in numerous stands and on open-grown trees; however, the dormant terminal buds were not affected by the weather and subsequent shoot development was normal.

NORTHERN REGION

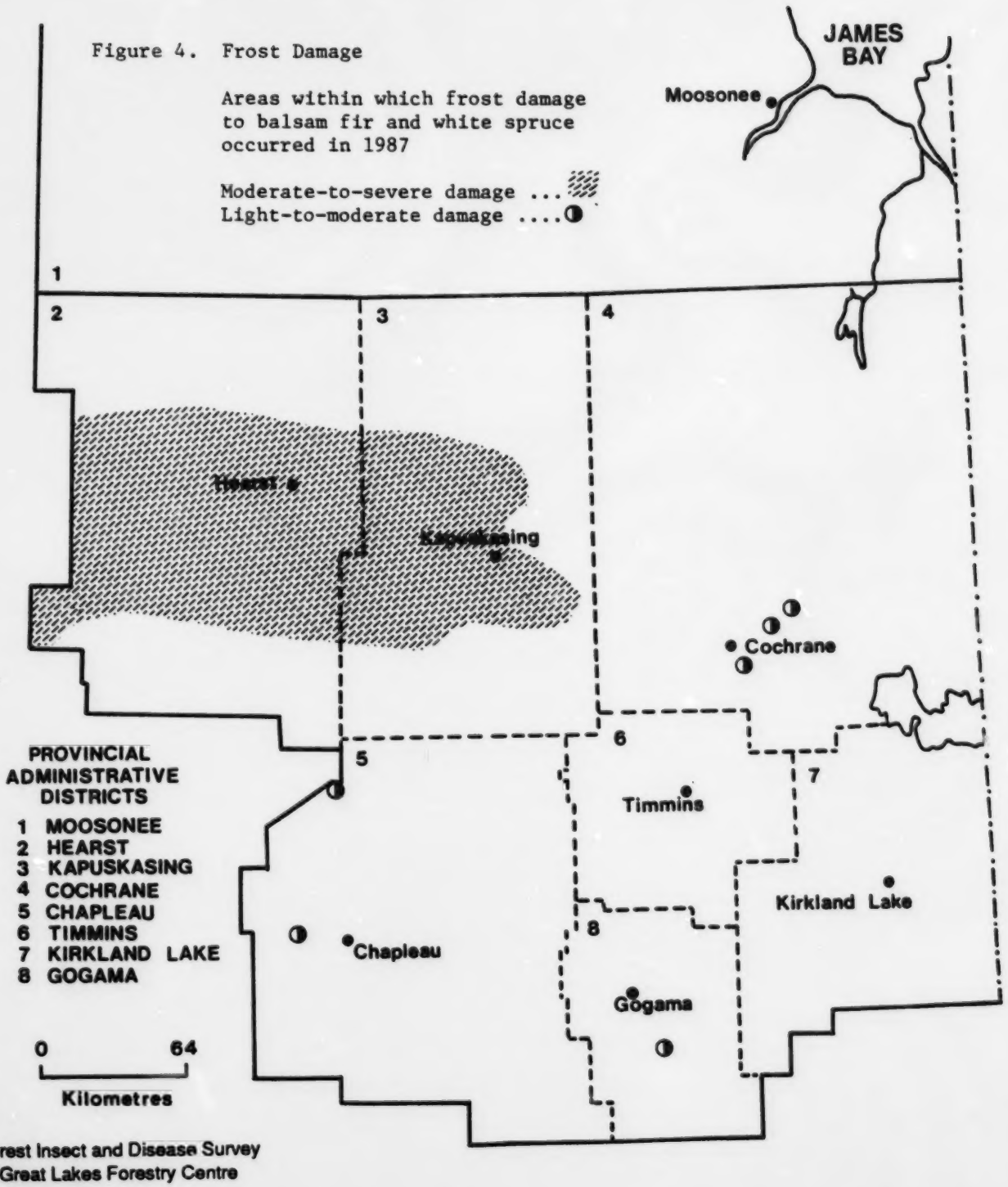


Table 14. Summary of damage caused by frost in five districts in the region in 1987 (counts based on the examination of 150 randomly selected trees as each location).

Location (Twp)	Host	Avg ht of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees damaged (%)	Foliar damage (%)
Chapleau District						
Gilliland	wS	1.0	2,500	40	19	3
Cochrane District						
Tweed	bF	2.0	1,600	20	60	80
St. John	bF	1.5	1,600	10	40	50
Pinard	wS	1.5	1,600	10	25	10
Gogama District						
Garibaldi	wS	1.9	2,200	20	42	3
Hearst District						
Studholme	wS	2.4	2,500	10	9	5
Arnott	wS	0.9	2,500	10	17	5
Studholme	tL	6.0	2,500	10	60	20
Rogers	bF	5.0	1,600	20	60	95
Frost	bF	5.0	1,200	10	75	80
Kapuskasing District						
Fauquier	eL	2.2	900	0.5	87	12
Nansen	wS	0.2	1,600	10	93	70
O'Brien	wS	4.0	1,600	5	35	5

SPECIAL SURVEYS

White Spruce Plantation Survey

In 1987 a special survey was conducted to assess the impact of insect and disease problems in 16 white spruce plantations in the region (Table 15). Stand selection was based on three height classes: <2 m, 2-6 m, and >6 m. A random sampling procedure was used and 150 trees were examined on two visits between 8 and 27 June and 13 and 24 July. The stands were evaluated for the presence of the following selected insects, diseases and abiotic damage:

Insects: spruce budworm, spruce coneworm (*Zeiraphera* sp.), yellowheaded spruce sawfly and white pine weevil.

Diseases: broom rust (*Chrysomyxa arctostaphyli* Dietel), dwarf mistletoe (*Arceuthobium pusillum* Peck), Armillaria root rot and spruce needle rust.

Abiotic Damage: Frost

Insects and diseases not found in the current survey:

Insects: spruce budworm, spruce coneworm.

Diseases: broom rust, dwarf mistletoe.

The special survey of white spruce revealed no serious pest problems in the region. Trace levels of white pine weevil were encountered in seven of the plantations. Light levels of yellowheaded spruce sawfly were found in three areas surveyed. After many years of spruce budworm damage in the region, it is interesting to note that no larvae were found in 1987.

Heavy damage caused by disease was not observed in any of the plantations. Needle rust was detected in four of the sampled areas but only at light levels. A trace of Armillaria root rot was found in two plantations.

Frost damage was observed in seven of the plantations examined. The highest incidence was in McEvay Township, Kirkland Lake District, where 82% of the trees were affected.

Table 15. Summary of the results of a special survey of 16 white spruce plantations in the Northern Region in 1987 (counts based on the examination of 150 randomly selected trees at each location) (concl.).

Location (Twp)	Estimated stand area (ha)	Estimated no. of trees per ha	Ht class (m)	Spruce budworm		Yellowheaded spruce sawfly		White pine weevil	Spruce coneworm	*Zeiraphera* sp.
				Trees attacked (%)	Defoliation (%)	Trees attacked (%)	Defoliation (%)	Trees attacked (%)	Trees attacked (%)	Trees attacked (%)
Chapleau District										
Gilliland	40	2,500	< 2	0	0	3.3	1	0	0	0
Lloyd	22	1,200	2-6	0	0	0	0	0	0	19.3
Marshall	40	2,000	< 2	0	0	0.6	3	0.6	0	0
Nimitz	10	1,000	> 6	0	0	0	0	0	0	0
Reeves	10	1,000	> 6	0	0	0	0	0	0	0
Cochrane District										
Clute	1	500	> 6	0	0	0	0	0	0	0
Gogama District										
Garibaldi	20	2,200	2-6	0	0	0	0	0.6	0	0
Hearst District										
Studholme	10	2,500	2-6	0	0	0	0	0.6	0	0
Arnott	10	2,500	<2	0	0	0	0	1.2	0	0
Kapuskasing District										
O'Brien	3	2,600	2-6	0	0	0	0	0.6	0	0
Opasatica	10	1,600	< 2	0	0	0	0	1.2	0	0
Fauquier	1	1,000	> 6	0	0	0	0	0	0	0
Kirkland Lake District										
Bryce	1	4,000	> 6	0	0	10.0	3	0	0	8.0
Chamberlain	2	3,000	> 6	0	0	0	0	0	0	20.7
McEvay	3	4,000	2-6	0	0	0	0	2	0	0
Mulligan	10	3,000	< 2	0	0	0	0	0	0	0

Table 15. Summary of the results of a special survey of 16 white spruce plantations in the Northern Region in 1987 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Estimated stand area (ha)	Estimated no. of trees per ha	Ht class (m)	Frost		*Armillaria mellea*	Needle rust	
				Trees affected (%)	Foliar damage (%)	Trees affected (%)	Trees affected (%)	Foliar damage (%)
Chapleau District								
Gilliland	40	2,500	< 2	18.7	2.5	1.3	0	0
Lloyd	22	1,200	2-6	0	0	0	0	0
Marshall	40	2,000	< 2	0	0	0.6	58.0	7.2
Nimitz	10	1,000	> 6	0	0	0	0	0
Reeves	10	1,000	> 6	0	0	0	0	0
Cochrane District								
Clute	1	500	> 6	0	0	0	0	0
Gogama District								
Garibaldi	20	2,200	2-6	43.0	2.6	0	12.7	1.0
Hearst District								
Studholme	10	2,500	2-6	8.7	5.0	0	0	0
Arnott	10	2,500	< 2	16.7	5.0	0	0	0
Kapuskasing District								
O'Brien	5	2,500	2-6	54.7	5.0	0	0	0
Opasatica	10	1,600	<2	0	0	0	0	0
Fauquier	1	1,000	>6	0	0	0	0	0
Kirkland Lake District								
Bryce	1	4,000	>6	0	0	0	0	0
Chamberlain	2	5,000	>6	0	0	0	4.7	1
McEvay	5	4,000	2-6	82.0	5	0	0	0
Mulligan	10	5,000	<2	10.7	4	0	80.7	12.0

(cont'd)

White Spruce Seed and Cone Pests

A scarcity of white spruce cones, probably caused by late spring frosts, limited cone sampling to one location in 1987. At the collection point 100 cones were taken from the total conebearing crowns of three trees. The sample was forwarded to the Great Lakes Forestry Centre (GLFC) for dissection and analysis (Table 16).

Table 16. Summary of white spruce seed and cone damage at one location in the Kirkland Lake District in 1987.

Location (Twp)	No. of cones examined	Damaged cones (%)	Seed loss within damaged cones (%)	Principal cause of seed loss (in order of importance)
Burt	100	34	28	*Lasiomma anthracinum* (Czerny) *Cydia strobilella* (L.) *(=youngana* [Kft.]) Lepidoptera *Dasineura rachiphaga* Tripp

Black Army Cutworm Traps

In recent years severe damage to seedlings planted on prescribed burns has occurred in Chapleau, Gogama and Hearst districts. Black army cutworm *(Actebia fennica* [Tausch.]) populations have been monitored by pheromone trapping in these districts since 1985. In 1987, traps deployed in Copperfield Township, Chapleau District, and in Dublin Township, Gogama District failed to capture any adult moths. Only four moths were caught in the trap in Nanson Township, Kapuskasing District, and no damage to seedlings was observed in the region.

Gypsy Moth Pheromone Traps

Pheromone trapping was continued in each of the 12 provincial parks and in one private park in the region to detect the presence of gypsy moth *(Lymantria dispar* [L.]). Ten traps were deployed in each park in which positive catches were recorded in 1986, viz., Mississagi, Wild River and Wakami Provincial Parks, Chapleau District, and Kap Kig I Wan Provincial Park, Kirkland Lake District. Two traps were located in each of the remaining parks. In 1987 male adult moths were captured in Fushimi Provincial Park, Hearst District, and in Kettle Lakes Provincial Park, Timmins District. At each of these locations only one adult was captured and trapping results from all other parks were negative.

Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

Surveys to detect the presence of the pinewood nematode were continued throughout the region. Jack pine, balsam fir, white spruce and black spruce trees that exhibited typical symptoms (chlorotic, dying or recently dead with needles attached) were sampled at 57 locations and discs were shipped to the Great Lakes Forestry Centre for analysis. The locations of positive samples (21) are shown in Figure 5. Since the nematodes are believed to be transferred from affected to healthy trees by feeding or ovipositing activity by sawyer beetles (*Monochamus* spp.) live adults were also captured and submitted to GLFC for examination (Fig. 6). To date, however, identification of the nematodes from these samples has not been completed.

Acid Rain National Early Warning System

The three study plots established in the region in 1984 and 1985 were resampled in 1987 (see photo page). All trees on the plots were examined and any changes were recorded. Aerial photos of all plots were taken as in previous years. In 1987 soil sampling was conducted for the first time. Ground cover plants were also examined and compared with those collected in 1986. Off-plot trees were sampled for insect and disease damage. In 1987, *Endrocronartium harknessii* caused minor damage in the jack pine plots located in Deans Township, Chapleau District, and in Cane Township, Kirkland Lake District. Also in the plot in Kirkland Lake District, trace levels of white pine weevil damage were observed. All samples were negative in the plot located in Hopkin Township, Kapuskasing District.

Climatic Data

Weather records for three stations, at Earlton, Chapleau and Kapuskasing airports, have been included in this report (Table 17). Weather plays an important part in insect development and the spread of infectious diseases, and is the cause of many noninfectious conditions such as frost and hail damage, winter drying and drought.

NORTHERN REGION

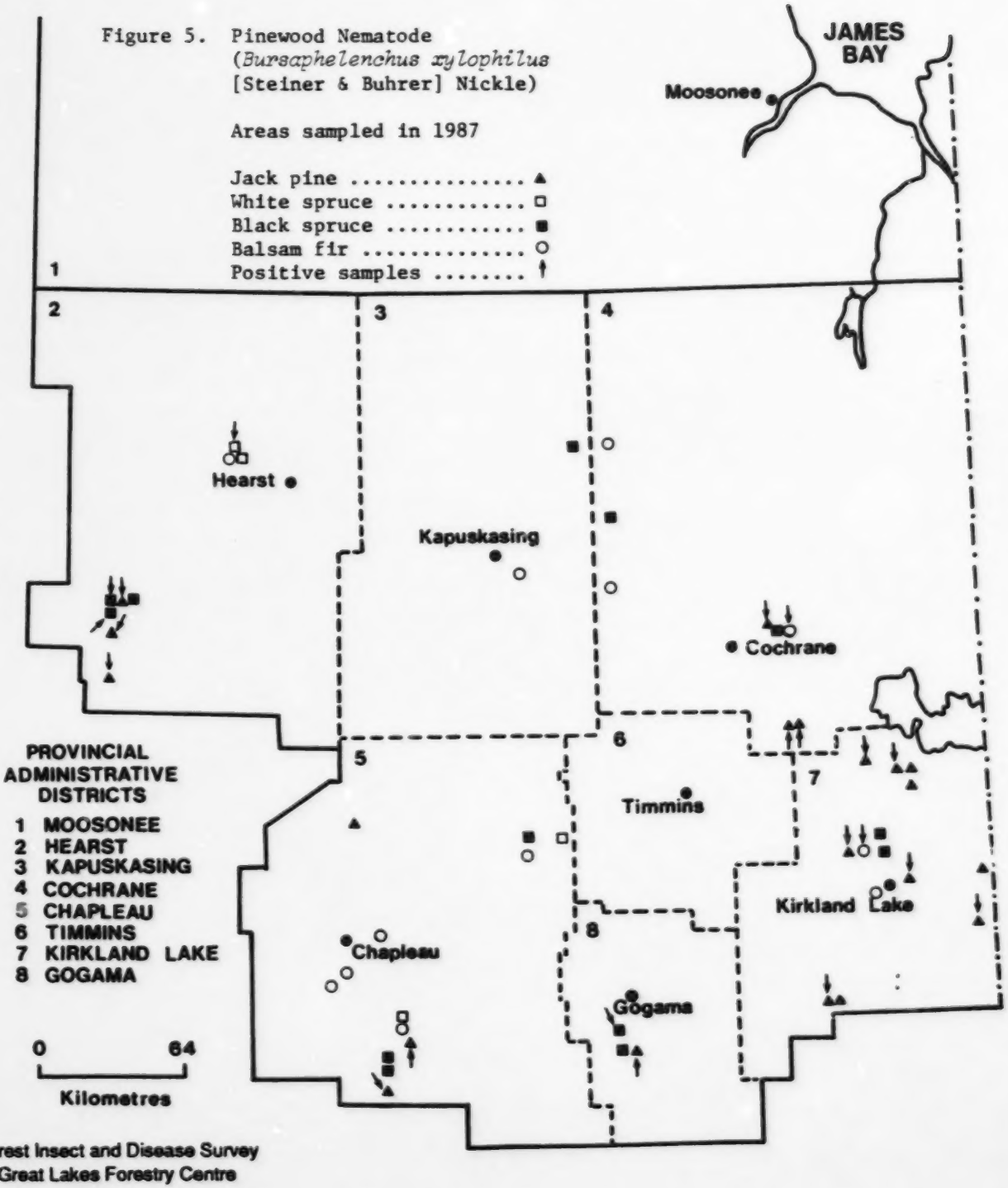


Figure 5. Pinewood Nematode (*Bursaphelenchus xylophilus* [Steiner & Buhrer] Nickle)

Areas sampled in 1987

NORTHERN REGION

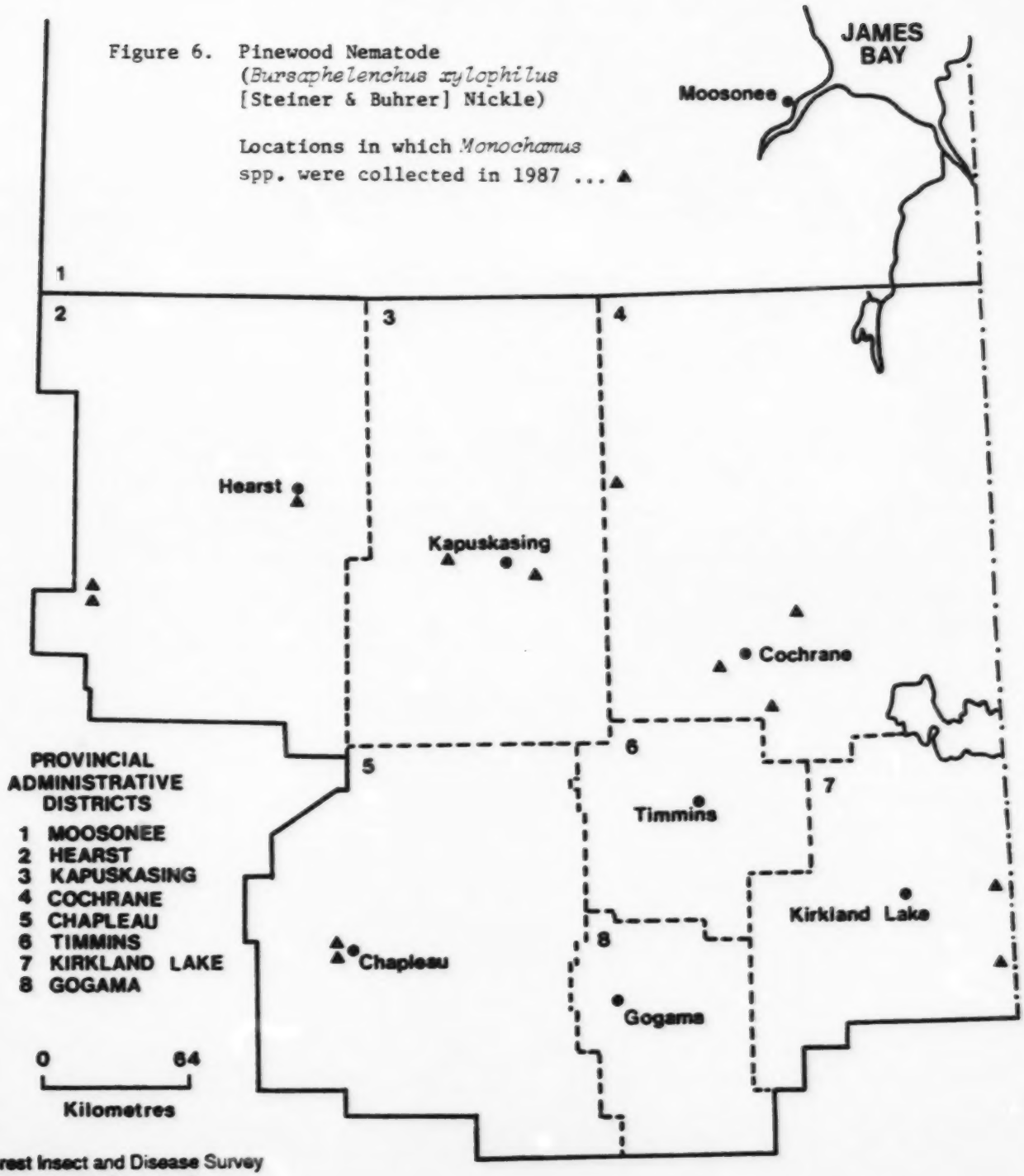


Figure 6. Pinewood Nematode (*Bursaphelenchus xylophilus* [Steiner & Buhrer] Nickle)

Locations in which *Monochamus* spp. were collected in 1987 ... ▲

Table 17. Summary of the mean temperature and total precipitation at three locations in the Northern Region in 1987.

Month	Mean temp. 1987 (°C)	Normal temp. (°C)	Deviation from norm. temp. (°C)	Total precip. (mm)	Normal precip. (mm)	Deviation from norm. precip. (mm)
			Earlton			
Jan.	-11.8	-16.3	+4.5	24.4	56.4	-32.0
Feb.	-12.1	-14.1	+2.0	30.2	47.2	-17.0
Mar.	-4.0	-7.6	+3.6	39.4	58.0	-18.6
Apr.	6.5	1.9	+4.6	26.2	50.0	-23.8
May	11.4	9.8	+1.6	42.8	61.3	-18.5
June	16.6	15.2	+1.4	63.4	89.2	-25.8
July	18.7	17.7	+1.0	100.1	80.8	+19.3
Aug.	15.9	16.2	-0.3	42.1	83.4	-41.3
Sept.	12.7	11.1	+1.6	67.2	99.1	-31.9
Oct.	3.9	5.4	-1.5	53.8	70.0	-16.2
Nov.	-2.7	-2.5	-0.2	43.4	70.6	-27.3
Dec.	-7.9	-12.6	+5.7	66.0	65.3	+0.7
			Chapleau			
Jan.	-11.5	-16.9	+5.4	36.4	46.9	-13.5
Feb.	-10.9	-15.8	+4.9	25.8	34.5	-8.7
Mar.	-5.7	-8.6	+2.9	49.7	56.2	-6.5
Apr.	7.9	0.6	+7.3	31.4	59.3	-27.9
May	10.6	8.6	+2.0	59.2	73.8	-14.6
June	15.4	14.3	+1.1	42.6	100.4	-57.8
July	18.0	16.8	+1.2	100.2	81.8	+19.4
Aug.	15.2	15.4	-0.2	56.2	86.2	-30.0
Sept.	12.0	10.4	+1.6	36.2	101.5	-65.3
Oct.	3.6	4.9	-1.3	34.4	75.7	-41.3
Nov.	-3.3	-3.5	-0.2	26.0	64.2	-38.2
Dec.	-12.0	-12.8	-0.8	74.0	53.5	+21.5
			Kapuskasing			
Jan.	-13.4	-18.6	+5.2	32.7	53.6	-20.9
Feb.	-13.5	-16.2	+2.7	16.6	43.0	-27.4
Mar.	-5.7	-9.4	+3.7	36.8	55.4	-18.6
Apr.	5.1	0.5	+4.6	21.6	53.2	-31.6
May	10.1	8.3	+1.8	38.0	74.3	-36.3
June	15.7	14.1	+1.6	76.8	84.7	-7.9
July	17.6	16.8	+0.8	140.8	96.3	+44.8
Aug.	15.1	15.3	-0.2	82.3	92.5	-10.2
Sept.	12.0	10.0	+2.0	59.3	94.4	-35.1
Oct.	2.0	4.4	-2.4	85.4	77.4	+8.0
Nov.	-4.6	-4.4	-0.2	55.6	80.1	-24.5
Dec.	-9.2	-14.7	+5.5	59.0	53.3	+5.7